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(54) Cooked ham manufacture.

(57) A process for manufacturing cooked ham, comprising trimming and cutting pig muscles into pieces, treating said pieces with a high hydrostatic pressure, injecting brine into the pressure treated pieces of pig muscles, tumbling, filling, cooking and cooling them.

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The present invention concerns the manufacture of cooked ham by a process comprising trimming and cutting pig muscles into pieces, injecting brine into the pieces, tumbling, filling, cooking and cooling them.

The object of the present invention is to provide a process for manufacturing cooked ham with an improved cooking yield without negatively affecting the texture.

To this end, the process according to the present invention comprises a step of treating said pieces of pig muscles with a hydrostatic pressure of from 300 to 2000 bar before injecting brine into them.

Actually it was surprisingly found that the cooking yield of a ham prepared according to the present invention could be improved by about 0.7 to 1.2%, for example, as compared with a cooked ham obtained by a traditional process comprising trimming and cutting pig muscles into pieces, injecting brine into them, tumbling, filling, cooking and cooling them, but without the texture of the ham being negatively affected or, even better, with this texture being possibly slightly improved.

For carrying out the present process, one can use muscles of pigs, especially the muscle called *M. vastus lateralis*, for example. The muscles may be trimmed from visible fat and connective tissue and cut in pieces.

For treating the pieces of pig muscles with a hydrostatic pressure of from 300 to 2000 bars, it is preferred to isolate them from a liquid, namely a water or an oil, for example, used for transmitting such a high hydrostatic pressure, by means of vacuum packing them in plastic bags, for example.

The packed pieces may be placed within a chamber of a high pressure equipment where the high hydrostatic pressure treatment may be carried out for a time and at a temperature adequate for obtaining an actual effect on the cooking yield and possibly on the texture of the ham. The treatment time may be up to 60 min, preferably up to 10 min, for example. This treatment time is reckoned from the moment when the hydrostatic pressure reaches the desired value, the time necessary for raising the pressure to this value being about one minute, for example. The treatment temperature may be from 2 to 60 °C, preferably from 5 to 25 °C, for example.

The pressure treated pieces of pig muscles may then be unpacked.

Brine may be injected into the unpacked pieces in an amount of from about 12 to 35% by weight of the pieces, the brine comprising, in percent by weight of the pieces:

- 1.0 to 3.0% nitrite curing salt,
- up to 3.0% sodium chloride,
- up to 3.0% dextrose,
- up to 0.6% phosphate, and
- up to 0.2% ascorbate, for example.

Said nitrite curing salt may consist of a mixture of sodium chloride with sodium nitrite, the amount of the latter representing from 0.3 to 1.0 %, preferably from 0.4 to 0.6% of the salt, for example.

Said phosphate may be sodium diphosphate and/or sodium triphosphate, for example.

Said ascorbate may be sodium ascorbate, for example.

Tumbling may be performed at atmospheric pressure or under vacuum in a tumbler cooled with water chilled at 0 to 10 °C, continuously or intermittently (with alternating tumbling times and resting times), for a total time of 2 to 24 h, for example.

The tumbled pieces may be filled in moulds or vacuum filled in natural or synthetic casings, the weight of the crude ham reconstituted in this way being about 1.5 to 3 kg, for example.

This crude ham may then be cooked at atmospheric pressure, at a relative humidity of from 80 to 100% and at 60 to 80 °C for 3 to 12 h, for example. Preferably, it is cooked in a first cycle at a relatively low temperature of from 60 to 70 °C until its core temperature is of from about 52 to 58 °C and in a second cycle at a relatively high temperature of from above 70 to 80 °C until its core temperature is of from about 65 to 75 °C.

The cooked ham may be cooled in a water bath until its core temperature is of from about 20 to 25 °C, and it may then be stored at refrigeration temperatures of from 2 to 8 °C, for example.

The examples hereafter illustrate different embodiments of the process and of the product according to the present invention. The percentages are by weight unless otherwise stated.

In these examples, the texture of the hams was evaluated by testing their hardness and their stress relaxation. For testing their hardness, cylindrical samples 18 mm in diameter and 50 mm in length were cut out from the hams and sheared with a Warner-Bratzler (W-B) shear press cell mounted on an Instron Universal Testing Machine (Model 1140). The cross head speed was 100 mm/min. The shear forces measured on 15 samples randomly distributed between the hams were averaged and expressed in N.

For testing their stress relaxation, cylindrical samples 18 mm in diameter and 25 mm in length were cut out from the hams and compressed with a cylindrical rod 0.5 mm in hight and 54 mm in diameter mounted on an Instron Universal Testing Machine (Model 1122). The cross head speed was 20 mm/min. The

samples were compressed vertically down to a thickness of 5 mm and hold there for 30 s. A stress relaxation was defined as the ratio between the forces measured at the beginning and at the end of the compression. The stress relaxations determined on 15 samples randomly distributed between the hams were averaged and expressed without dimension.

The cooking yield was calculated from the weight of the hams taken before and after cooking and expressed in percents without dimension.

Example 1

Muscles *M. vastus lateralis* of the leg of pigs were delivered 72 h post mortem and divided in two batches of 20 kg each. The muscles from the one batch were used for preparing cooked ham by a process according to the present invention. The muscles from the other batch were used for preparing cooked ham according to the same process but without the step of treating the pieces of pig muscles with a high hydrostatic pressure.

The muscles were trimmed from visible fat and connective tissue and cut in two pieces of about 500 g each. The pieces were packed individually in plastic bags under vacuum with an Inauer VC 999/09 sealer.

The treatment with a high hydrostatic pressure was carried out with a National Forge machine having a high pressure chamber of 8.6 l. The packed pieces were treated batchwise with a hydrostatic pressure of 1000 bar for 10 min at about 10 °C. The pressure treated pieces were then unpacked.

A brine to be injected into the unpacked pieces in an amount of 15% was prepared 24 h before use and had the following composition:

Nitrite curing salt (0.6% $NaNO_2$)	15.33%
Sodium chloride	3.83%
Dextrose	15.33%
Tetrasodium pyrophosphate	1.53%
Sodium ascorbate	0.23%

The brine was injected into the unpacked pieces with a Fomaco FGM 20/40 multineedle injector under an injection pressure of about 1 bar and at a temperature of about 9 °C.

The pieces were then tumbled under vacuum with a Stephan VM 60 tumbler at 2-4 °C for a total time of 4 h, 45 min tumbling times alternating with 15 min resting times.

The tumbled pieces of pig muscles were vacuum filled in synthetic fibrous casings 110 mm in diameter with a Handtmann Vacuum filler VF 80 so that the crude hams reconstituted in this way had a weight of about 2 kg.

The crude hams were cooked in a Salvis Combisteam CSC 111 at atmospheric pressure and at a relative humidity of 100% in two cooking cycles. In the first cycle the oven temperature was set at 64 °C until the core temperature of the hams was 55 °C. In a second cycle the oven temperature was increased to 74 °C until the core temperature of the hams was 68 °C. The total cooking time was about 4 h.

The cooked hams were cooled for 2 h in a water bath at 6 °C. They had then a core temperature of about 23 °C. They were then stored overnight at 4 °C.

The cooking yield and the texture of the hams thus obtained and those of the control samples were tested as disclosed above. The results are presented in Table 1 hereafter.

Table 1

Pressure (bar)	Cooking Yield (%)	Shear force (N)	Stress rel. (dimensionless)
0 (control)	95.45	25.7	1.63
1000	96.61	25.4	1.54

It may be seen in Table 1 that the cooked ham obtained by the process of the present invention had a cooking yield improved by 1.16% as compared with the control sample which was not pressure treated, without its texture being negatively affected (same shear force as control) and even with this texture being slightly improved (stress relaxation slightly better than control, a smaller ratio of compressing forces being better).

Example 2:

Cooked hams were manufactured as disclosed in Example 1 except the fact that the treatment with a hydrostatic pressure of 1000 bar was carried out for 20 min instead of for 10 min.

The cooking yield and the texture of the hams thus obtained and those of the control samples were tested as disclosed above. The results are presented in Table 2 hereafter.

Table 2

Pressure (bar)	Cooking Yield (%)	Shear force (N)	Stress rel. (dimensionless)
0 (control)	96.79	32.6	1.60
1000	97.48	34.1	1.65

It may be seen in Table 2 that the cooked ham obtained by the process of the present invention had a cooking yield improved by 0.69% as compared with the control sample which was not pressure treated, without its texture being negatively affected (nearly same stress relaxation as control) and even with this texture being slightly improved (slightly higher shear force than control).

Example 3:

Cooked hams were manufactured as disclosed in Example 1 except the fact that a brine having the following composition was injected into the unpacked pieces in an amount of 30%:

Nitrite curing salt (0.6% $NaNO_2$)	8.66%
Sodium chloride	2.17%
Dextrose	8.66%
Tetrasodium pyrophosphate	0.87%
Sodium ascorbate	0.13%

The cooking yield and the texture of the hams thus obtained and those of the control samples were tested as disclosed above. The results are presented in Table 3 hereafter.

Table 3

Pressure (bar)	Cooking Yield (%)	Shear force (N)	Stress rel. (dimensionless)
0 (control)	96.21	25.2	1.52
1000	97.12	21.5	1.45

It may be seen in Table 3 that the cooked ham obtained by the process of the present invention had a cooking yield improved by 0.91% as compared with the control sample which was not pressure treated, without its texture being negatively affected (slightly lower shear force compensated by a slightly lower stress relaxation than control).

Comparative example (I):

Cooked hams were manufactured as disclosed in Example 1 except the fact that the brine was injected into the pieces before the pieces were packed, treated with a hydrostatic pressure of 1000 bar and unpacked, instead of afterwards.

The cooking yield and the texture of the hams thus obtained and those of the control samples were tested as disclosed above. The results are presented in Table (i) hereafter.

Table (i)

Pressure (bar)	Cooking Yield (%)	Shear force (N)	Stress rel. (dimensionless)
0 (control)	94.37	23.7	1.59
1000 (comparative)	93.61	21.0	1.62

It may be seen in Table (i) that the cooked ham obtained by the process of this first comparative example had a cooking yield diminished as compared with the control sample which was not pressure treated.

Comparative example (ii):

Cooked hams were manufactured as disclosed in Example 1 except the fact that the brine was not injected into the unpacked pieces but was simply added to them into the tumbler at the beginning of the tumbling step.

The cooking yield and the texture of the hams thus obtained and those of the control samples were tested as disclosed above. The results are presented in Table (ii) hereafter.

Table (ii)

Pressure (bar)	Cooking Yield (%)	Shear force (N)	Stress rel. (dimensionless)
0 (control)	95.16	22.5	1.62
1000 (comparative)	95.14	22.9	1.72

It may be seen in Table (ii) that the cooked ham obtained by the process of this second comparative example had a cooking yield unchanged as compared with the control sample which was not pressure treated.

Claims

1. A process for manufacturing cooked ham, comprising trimming and cutting pig muscles into pieces, treating said pieces with a hydrostatic pressure of from 300 to 2000 bar, injecting brine into the pressure treated pieces of pig muscles, tumbling, filling, cooking and cooling them.

2. A process according to claim 1, comprising trimming and cutting pig muscles into pieces, vacuum packing said pieces, treating the packed pieces with a hydrostatic pressure of from 300 to 2000 bar for up to 60 min at a temperature of from 2 to 60 °C, unpacking the pressure treated pieces of pig muscles, injecting brine into them, tumbling, filling, cooking and cooling them.

4. A process according to claim 2, which comprises treating said packed pieces with a hydrostatic pressure of from 300 to 2000 bar for up to 10 min at 5 to 25 °C.

5. A process according to claim 1, in which said brine is injected into the pieces of pig muscles in an amount of from about 12 to 35% by weight of the pieces, the brine comprising, in percent by weight of the pieces:

- 1.0 to 3.0% nitrite curing salt
- up to 3.0% sodium chloride
- up to 3.0% dextrose
- up to 0.6% phosphate
- up to 0.2% ascorbate

6. A process according to claim 1, in which said tumbling is performed under vacuum at 0 to 10 °C for 2 to 24 h.

7. A process according to claim 1, in which the tumbled pieces are filled in moulds or vacuum filled in casings.

8. A process according to claim 1, in which said cooking is performed at atmospheric pressure, at a relative humidity of from 80 to 100% and at 50 to 80 °C for 3 to 12 h.

9. Cooked ham manufactured by a process according to any of claims 1 to 8.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 81 0310

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DATABASE WPI Week 9301, Derwent Publications Ltd., London, GB; AN 93-006225 & JP-A-4 335 873 (T. NAKAJO ET AL.) 24 November 1992 * abstract * ---	1	A23L1/31 A23L3/015 A23B4/00
X	PREPARED FOODS, vol.162, no.2, February 1993 pages 49 - 50 PF 'Pateurization revisited' * page 50, column 1, line 13 - line 15; figure 1 * ---	1	
A	FOOD TECHNOLOGY, vol.47, no.6, June 1993, CHICAGO, ILLINOIS US pages 150 - 155 D.G.HOOVER 'Pressure effects on biological systems' * page 154, line 9 - line 11 * ---	1	
A	DATABASE WPI Week 9314, Derwent Publications Ltd., London, GB; AN 93-111803 & JP-A-5 049 391 (NIPPON HAM KK) 2 March 1993 * abstract * ---	1	
A	WO-A-92 018 011 (TULIP INTERNATIONAL) * claim 2 * ---	1	
A	EP-A-0 274 334 (CLAUDE DREANO) * abstract * --- -/--	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A23L
A23B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	13 October 1994	Alvarez Alvarez, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 81 0310

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DATABASE WPI Week 7634, Derwent Publications Ltd., London, GB; AN 76-64376X & JP-B-51 024 586 (NIPPON SHOKUHIN KAK KK) 25 July 1976 * abstract * ---	5	
A	DATABASE WPI Week 9333, Derwent Publications Ltd., London, GB; AN 93-260777 & JP-A-5 176 673 (ALON WORLD KK ET AL.) * abstract * ---		
A	FOOD SCIENCE AND TECHNOLOGY ABSTRACTS AN - 91:7717 DN - 91-06-E0029 International Food Information Service Berkshire, Reading, GB M. OKAMOTO et al. "Application of high pressure to food processing..." & AGRICULTURAL AND BIOLOGICAL CHEMISTRY vol. 54 no. 1 1990 pages 183-189 * abstract * ---		TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	FOOD SCIENCE AND TECHNOLOGY ABSTRACTS AN - 92:10470 DN - 92-07-S0106 International Food Information Service Berkshire Reading GB K. KIM et al. "Pressure-induced conversion of ..." & MEAT SCIENCE vol. 32 no. 2 1992 pages 237-243 * abstract * ---		
	-/--		

The present search report has been drawn up for all claims

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EPO FORM 1503 03.82 (P0401)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 81 0310

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	FOOD TECHNOLOGY, vol.47, no.6, June 1993, CHICAGO, ILLINOIS US pages 164 - 169 B. MERTENS ET AL. 'engineering aspects of high-pressure...' -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	13 October 1994	Alvarez Alvarez, C

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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0C01)

TRATADO DE COOPERACIÓN EN MATERIA DE PATENTES

Remitente: LA ADMINISTRACIÓN ENCARGADA
DE LA BÚSQUEDA INTERNACIONAL

Destinatario:
MANRESA VAL, Manuel
RAMBLA DE CATALUNYA 32
08007 BARCELONA
- ESPAÑA -

PCT

OPINIÓN ESCRITA DE LA ADMINISTRACIÓN ENCARGADA DE LA BÚSQUEDA INTERNACIONAL

(Regla 43*bis*.1 del PCT)

Fecha de expedición *(día/mes/año)*	28.03.2005
Referencia del expediente del solicitante o del mandatario	**PARA CONTINUAR LA TRAMITACIÓN** Véase el punto 2

Solicitud internacional Nº	Fecha de presentación internacional *(día/mes/año)*	Fecha de prioridad *(día/mes/año)*
PCT/ES2004/000548	**07 DICIEMBRE 2004 (07.12.2004)**	**05 DICIEMBRE 2003 (05.12.2003)**

Clasificación Internacional de Patentes (IPC) o a la vez clasificación nacional e IPC
A23B 4/023, 4/005, 4/06, 4/015

Solicitante **CURUTCHET FERREIRA, Pablo Roman, INTA INSTITUTO NACIONAL DE TECNOLOGIA AGROPECUARIA, Ararav. Rivada, y otros.**

1. La presente opinión contiene indicaciones relativas a los puntos siguientes:

☒	Recuadro I	Base de la opinión
☐	Recuadro II	Prioridad
☐	Recuadro III	No formulación de opinión sobre la novedad, la actividad inventiva y la aplicación industrial
☐	Recuadro IV	Falta de unidad de invención
☒	Recuadro V	Declaración motivada según la Regla 43*bis*.1.a)i) sobre la novedad, la actividad inventiva y la aplicación industrial; citas y explicaciones en apoyo de esta declaración
☐	Recuadro VI	Ciertos documentos citados
☐	Recuadro VII	Defectos en la solicitud internacional
☐	Recuadro VIII	Observaciones relativas a la solicitud internacional

2. **CONTINUACIÓN DE LA TRAMITACIÓN**
Si se hace una petición de examen preliminar internacional, esta opinión se considerará como una opinión escrita de la Administración encargada del examen preliminar internacional ("IPEA") salvo en aquellos casos en los que el solicitante elija una Administración distinta a ésta y, la IPEA elegida haya notificado a la Oficina Internacional según lo previsto en la Regla 66.1*bis*(b) que las opiniones escritas de esta Administración encargada de la búsqueda internacional no serán consideradas como tales.

Si esta opinión es, como se indica más arriba, considerada como una opinión escrita de la IPEA, se invita al solicitante a que presente ante la IPEA una respuesta por escrito junto con modificaciones, en su caso, antes de la expiración del plazo de 3 meses a contar desde la fecha de envío del formulario PCT/ISA/220 o antes de la expiración del plazo de 22 meses a contar desde la fecha de prioridad, aplicándose el plazo que expire más tarde.

Para otras opciones, consultar el formulario PCT/ISA/220.

3. Para más detalles, ver las notas del formulario PCT/ISA/220.

Nombre y dirección postal de la Administración encargada de la Búsqueda Internacional **OFICINA ESPAÑOLA DE PATENTES Y MARCAS** **C/ Panamá, 1 - 28071 Madrid (España)** Nº de fax: **91 349 53 04**	Funcionario autorizado **López Nieto, Juana** Nº de teléfono: **91 349 55 36**

OPINIÓN ESCRITA DE LA ADMINISTRACIÓN ENCARGADA DE LA BÚSQUEDA INTERNACIONAL

Solicitud internacional Nº
PCT/ES2004/000548

Recuadro I. Base de la opinión

1. Por lo que respecta al **idioma** esta opinión se ha establecido sobre la base de la solicitud internacional en el idioma en el cual se depositó, salvo indicación en contra señalada a continuación.
   ☐ Esta opinión se ha establecido sobre la base de una traducción del idioma original al siguiente idioma _____, que es el idioma de una traducción proporcionada a los fines de la búsqueda internacional (según las Reglas 12.3 y 23.1 b)).

2. En lo que se refiere a **las secuencias de nucleótidos y/o de aminoácidos** divulgadas en la solicitud internacional y necesarias para la invención reivindicada, esta opinión se ha establecido sobre la base de:

   a. Tipo de material
      ☐ una lista de secuencias
      ☐ tabla(s) relativa(s) a la lista de secuencias

   b. Formato del material
      ☐ por escrito
      ☐ en soporte legible por ordenador

   c. Fecha de presentación/entrega
      ☐ contenido en la solicitud internacional tal y como se presentó
      ☐ presentado junto con la solicitud internacional en formato legible por ordenador
      ☐ presentado posteriormente a esta Administración a los fines de la búsqueda

3. ☐ Además, en caso de que se haya presentado más de una versión o copia de una lista de secuencias y/o tabla relacionada con ella, se ha entregado la declaración requerida de que la información contenida en las copias subsiguientes o adicionales es idéntica a la de la solicitud tal y como se presentó o no va más allá de lo presentado inicialmente.

4. Comentarios adicionales:

OPINIÓN ESCRITA DE LA ADMINISTRACIÓN ENCARGADA DE LA BÚSQUEDA INTERNACIONAL

Solicitud internacional Nº PCT/ES2004/000548

Recuadro V. Declaración motivada según la Regla 43*bis*.1.a)i) sobre la novedad, la actividad inventiva y la aplicación industrial; citas y explicaciones en apoyo de esta declaración

1. Declaración

Novedad	Reivindicaciones	1-3	SÍ
	Reivindicaciones		NO
Actividad inventiva	Reivindicaciones	1-3	SÍ
	Reivindicaciones		NO
Aplicación industrial	Reivindicaciones	1-3	SÍ
	Reivindicaciones		NO

2. Citas y explicaciones

Documentos tenidos en consideración.

Doc.	Número Publicación o Identificación	Fecha Pub.
D01	EP0683986A1	29.11.1995
D02	GB2288308A	18.10.1995

Ninguno de los documentos del estado de la técnica anterior a la solicitud citados por la Oficina Internacional de Búsqueda, tomados solos o en combinación, revelan la invención definida en las reivindicaciones 1-3. Además, en los documentos citados no hay sugerencias que dirijan al experto en la materia hacia la invención definida por las reivindicaciones 1-3. Así, la invención reivindicada en las reivindicaciones 1-3 es, con referencia a los documenrtos D01 y D02 nueva y se considera que implica actividad inventiva y aplicación industrial de acuerdo con el artículo 33(2, 3, 4) PCT.